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ABSTRACT

This evaluation of the long-term effect of attending an all-day kindergarten program on academic achievement found that students in grade 1 who had attended the all-day program had a significant advantage over students who had attended a traditional half-day program. A 3-year longitudinal assessment was made for two cohorts of students, one that started grade 1 in 1987 and one that started grade 1 in 1988. Elementary school achievement test scores of students who had attended the full-day program were compared with the scores of students who had attended a half-day program. A previous study evaluated the effects of attending the full-day program on the 1987 cohort for the first 2 years of elementary school. Both studies found a significant advantage of the full-day program over the half-day program. However, the achievement difference between the groups lost significance after the first year of elementary school for the 1987 cohort. The difference remained significant for the 1988 cohort in the second year, but further study is needed to determine whether this difference remains prominent. Statistical data are presented in 14 tables. A list of five references is appended. (FMW)

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CHAPTER 3

A Study of the Longtitudinal Effects of All-Day Kindergarten Attendance on Achievement

Matthijs Koopmans

Introduction

The purpose of the present study is to evaluate the long term effectiveness of an all-day kindergarten program that was implemented in eleven schools in the Newark district in 1985-1986 school year, with three more schools added in the subsequent year. In order to determine the effectiveness of all-day kindergarten programs, their effects have been compared to those of regular half-day kindergarten instruction, which took place in the same schools. Previous work has generally confirmed the hypotheses that all-day kindergarten attendance benefits school children for quite some time in the course of the elementary school years (See Karweit et. al., 1987; Azumi, in this volume).

It also appears that all-day attendance is particularly beneficial to children from minority groups (McDill, Karweit, Natriello & Pallas, 1989). It is important to specifically establish kindergarten attendance effects for minority populations, since the studies previously cited imply that the relatively disadvantaged position of minority groups in the educational process which has given rise to Head Start, Follow Through, and the like, could be partly remedied by offering more extensive kindergarten instruction, instead of remedial programs during elementary school.

This study is specifically concerned with the long term effects of all-day or half-day kindergarten program attendance on achievement during the elementary school years. Children who were enrolled in elementary school classes in 1985-1986, and those enrolled in 1986-1987 were included in the

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study. Achievement among children in both cohorts has been evaluated in the following areas: word attack, vocabulary, reading comprehension, math computation, and math concepts and applications. Performance data on a standardized achievement test, the Comprehensive Test of Basic Skills (CTBS), is used in all the analysis. The first three areas measure language and reading ability, the latter two measure math ability.

Previous evaluations of the performance of the first cohort in this analysis revealed that all-day kindergarten students scored consistently higher in elementary school than half-day groups; there appeared to be an over-representation of the half-day group in the bottom quartile of the testing scale, and a majority of all-day children in the top quartile. This advantage of the all-day group persisted regardless of the particular cognitive domain considered, the age difference within grades, and the degree of school readiness at the beginning of the kindergarten year. The consistency of these effects has led to the recommendation to implement all-day kindergarten programs more extensively in the district (See Azumi, 1986;1987).

The present study, a follow up to these previous evaluation studies has been conducted to determine whether the difference between all-day and half-day groups persists for the third year of elementary school. In addition, an assessment of the long term effects could be made for the second cohort which entered elementary school one year later.

HYPOTHESIS

It was hypothesized that the advantage observed for the all-day kindergarten group would remain in effect for the first cohort, and that the effects for the second cohort would be consistent with those observed in the first cohort: in other words, in the second cohort, there should be an advantage for the all-day group as well. Second, it was hypothesized that the changes over time would be the same for the all-day and half-day groups. In other words, no interaction between time and kindergarten attendance group was expected.

EVALUATION DESIGN

The longitudinal evaluation was performed using a repeated measures analysis of variance design with time as a repeated measure, and all-day versus half-day attendance as a predictor. Outcome variables are the scores for each academic area in each year. Separate ANOVA models were fitted for the different subtests. Before performing the repeated measures analysis; univariate statistics were obtained to test for assumptions, and to determine the central tendency and variability (mean, standard deviation) for each subtest score, each year, for each cohort, broken down by all-day versus half-day kindergarten attendance. In addition, means and standard deviations were obtained for the kindergarten testing scores, and pre-kindergarten school readiness. The letter variable serves as covariate in the longitudinal analysis. Furthermore, regular two-way analyses of variance models were tested in which the subtest scores for each year were predicted on the basis of kindergarten attendance group.

RESULTS

To assess the effects of receiving all-day kindergarten instruction, CTBS scores were compared for each subtest. To test for the significance of the difference between all-day and half-day groups, oneway analysis of variance models were fitted with all-day versus half-day kindergarten attendance as a criterion variable.

Table 1 shows the means and standard deviations for word attack in the first cohort (1985-1986). Analyses of variance testing for the effect of all-day versus half-day kindergarten attendance in each year reveal that all-day and half-day groups differ significantly only in 1987 at the end of first grade. It can also be seen that this difference is in favor of the all-day group. In the second cohort (1986-1987), there is a significant difference between the half-day and all-day groups in both years at the end of first and second grade in favor of the all-day group (See Table 2).

Table 3 shows the results for vocabulary in the first cohort. Differences between the all-day and half-day groups are significant only in 1987 at the end of first grade. The results for the second cohort are shown in Table 4. It again appears that both in 1988 at the end of first and second grades and 1989, the all-day group does significantly better than the half-day group.

For the first cohort of students, the all-day group performs better on reading comprehension than the half-day group in all three years, and at the end of first, second and third grade although the difference between the two kindergarten groups is not statistically significant (Table 5). In the second cohort, there are clear differences between the all-day and half-day groups in 1988 at the end of first as well as second grade, in favor of the all-day groups (Table 6). This is consistent with those observed for word attack and vocabulary scores.

Table 1 Word Attack 1987 through 1989; Cohort 1985-1986. Means, Standard deviations, group size and ANOVA results.

Year:	1987			
	Mean	Std	N	F
All-day	56.604	(16.961)	43	5.4007*
Half-day	48.179	(15.746)	39	
Total	52.598	(16.835)	82	
Year:	1988			
All-day	53.465	(20.523)	43	1.6231
Half-day	47.846	(19.287)	39	
Total	50.792	(20.022)	82	
Year:	1989			
All-day	54.861	(14.734)	43	.4679
Half-day	52.718	(13.509)	39	
Total	53.842	(14.119)	82	

Table 2 Word Attack 1988 through 1989; Cohort 1986-1987. Means, Standard deviations, group size and ANOVA results.

Year:	1988			
	Mean	Std	N	F
All-day	56.061	(16.450)	115	11.342***
Half-day	47.314	(18.202)	69	
Total	52.751	(17.131)	185	
Year:	1989			
All-day	52.791	(19.471)	115	16.254***
Half-day	41.242	(17.895)	70	
Total	48.422	(18.893)	185	

* p .05
*** p .001

Table 3 Vocabulary 1987 through 1989; Cohort 1985-1986. Means, Standard deviations, group size and ANOVA results.

Year:	1987			
	Mean	Std	N	F
All-day	63.302	(17.125)	43	6.3193**
Half-day	54.359	(14.859)	39	
Total	59.048	(16.608)	82	
Year:	1988			
All-day	53.977	(19.541)	43	.1153
Half-day	52.513	(19.442)	39	
Total	53.281	(19.388)	82	
Year:	1989			
All-day	47.000	(16.972)	43	.6361
Half-day	44.359	(12.400)	39	
Total	45.744	(14.941	82	

Table 4 Vocabulary 1988 through 1989; Cohort 1986-1987. Means, Standard deviations, group size and ANOVA results.

Year:	1988			
	Mean	Std	N	F
All-day	63.487	(12.276)	115	29.5244***
Half-day	51.957	(16.343)	69	
Total	59.163	(13.935)	184	
Year:	1989			
All-day	56.035	(20.086)	115	17.204***
Half-day	43.400	(20.086)	70	
Total	51.254	(20.091)	185	

** p .01
*** p .001

Table 5 Reading Comprehension 1987 through 1989; Cohort 1985-1986.
Means, Standard deviations, group size and ANOVA results.

Year:	1987			
	Mean	Std	N	F
All-day	50.000	(16.120)	43	2.4126
Half-day	53.307	(17.053)	39	
Total	52.293	(16.714)	82	
Year:	1988			
All-day	54.798	(20.389)	43	1.349
Half-day	49.641	(19.666)	82	
Total	46.767	(15.674)	43	
Year:	1989			
All-day	46.767	(15.674)	43	.1207
Half-day	45.615	(14.212)	39	
Total	46.219	(14.915)	82	

Table 6 Reading Comprehension 1988 through 1989; Cohort 1986-1987.
Means, Standard deviations, group size and ANOVA results.

Year:	1988			
	Mean	Std	N	F
All-day	60.948	(17.308)	115	22.988***
Half-day	47.671	(19.474)	70	
Total	55.924	(18.266)	185	
Year:	1989			
All-day	52.217	(21.978)	115	19.317***
Half-day	42.214	(19.323)	70	
Total	50.919	(21.016)	185	

*** p .001

Although all-day children have better test scores on math computation than half-day children in the first cohort (Table 7), the difference is not significant in any year. Table 8 shows that in the second cohort, the all-day group outperforms the half-day group to a significant extent, both in first and second grades. The comparison of all-day and half-day groups on concept and applications in the first cohort reveals no significant differences between the two groups in any year (Table 9). The second cohort on the other hand show a more consistent pattern where the all-day group scores significantly higher than the all-day group (Table 10).

Effects of Kindergarten Attendance on Elementary School Performance Over Time

In order to determine the effects of all-day versus half-day kindergarten attendance on elementary school performance over the years, repeated measures analysis of variance models were fitted for each cognitive domain. The primary interest in the study is to assess differences between the two groups in elementary school performance, differences between the two groups that already existed in kindergarten prior to assignment to all-day or half-day groups were controlled for. The covariate used is a school readiness score determined prior to kindergarten enrollment.

Differences according to school readiness are shown in Tables 11 and 12. It appears that in both cohorts the all-day group has a higher readiness score than the half-day group (indicating less school readiness). Composite reading and math test scores at the end of kindergarten are shown in Table 12. They reveal a pronounced difference between all and half-day groups in both reading and math in both cohorts, in favor of the all-day group; a result which reveals the success of all-day kindergarten attendance, an indication that the all-day group entered first grade in a relatively advantageous position. A repeated measures analysis is conducted in order to determine whether these effects are lasting.

Table 7 Math Computation 1987 through 1989; Cohort 1985-1986. Means, Standard deviations, group size and ANOVA results.

Year:	1987			
	Mean	Std	N	F
All-day	60.581	(17.884)	43	2.3572
Half-day	53.897	(21.506)	39	
Total	57.402	(19.852)	82	
Year:	1988			
All-day	62.628	(20.785)	43	1.355
Half-day	56.718	(25.142)	39	
Total	59.817	(23.010)	82	
Year:	1989			
All-day	59.047	(18.276)	43	
Half-day	58.103	(20.812)	39	
Total	58.598	(19.407)	82	

Table 8 Math Computation 1988 through 1989; Cohort 1985-1986. Means, Standard deviations, group size and ANOVA results.

Year:	1988			
	Mean	Std	N	F
All-day	64.139	(17.127)	115	12.037***
Half-day	54.429	(20.479)	70	
Total	60.465	(18.463)	185	
Year:	1989			
All-day	66.600	(25.010)	115	16.946***
Half-day	56.257	(19.172)	70	
Total	61.173	(22.984)	185	

*** p .001

Table 9 Math concepts and applications 1987 through 1989; Cohort 1985-1986. Means, Standard deviations, group size and ANOVA results.

Year:	1987			
	Mean	Std	N	F
All-day	66.535	(21.921)	43	.6350
Half-day	62.513	(23.784)	39	
Total	64.622	(22.774)	82	
Year:	1988			
All-day	50.349	(21.507)	43	1.462
Half-day	46.769	(22.337)	39	
Total	48.646	(21.843)	82	
Year:	1989			
All-day	54.256	(19.145)	43	1.462
Half-day	49.513	(16.039)	39	
Total	52.000	(17.788)	82	

Table 10 Math concepts and applications 1988 through 1989; Cohort 1985-1986. Means, Standard deviations, group size and ANOVA results.

Year:	1988			
	Mean	Std	N	F
All-day	71.730	(18.719)	115	22.019***
Half-day	57.914	(20.531)	70	
Total	66.503	(19.422)	185	
Year:	1988			
All-day	59.217	(20.894)	115	22.099***
Half-day	45.229	(17.339)	70	
Total	53.924	(19.629)	185	

*** p .001

Table 11 Kindergarten readiness scores All-day Half-day programs. Means, Standard deviations, group size and ANOVA results.

Year:	1985-1986 Cohort		
	Mean	Std	N
All-day	12.978	(5.175)	43
Half-day	14.667	(6.045)	39
Year:	1986-1987 Cohort		
All-day	14.363	(5.113)	115
Half-day	15.809	(4.704)	70

Table 12 Composite reading and composite math scores Kindergarten; Both Cohorts All-day and Half-day programs. Means and Standard deviations.

Year:	1985-1986 Cohort, Reading		
	Mean	Std	N
All-day	68.714	(15.717)	42
Half-day	53.784	(19.522)	37
Total	61.722	(19.026)	79
Year:	1985-1986; Math		
All-day	67.146	(14.166)	41
Half-day	59.216	(17.185)	37
Total	63.385	(16.069)	78
Year:	1986-1987; Reading		
All-day	63.363	(17.396)	113
Half-day	59.464	(21.366)	69
Total	59.231	(19.669)	182
Year:	1986-1987; Math		
All-day	66.469	(14.919)	113
Half-day	56.870	(20.394)	69
Total	62.830	(17.771)	182

1985-1986 Cohort

Table 13 shows the results for each subtest for the first cohort. It appears that there are no significant main effects of program or time on word attack, the significance of time is observed on the vocabulary scores. It appears that over the years, vocabulary scores go down to a significant extent (See also Table 3). There is a significant downward trend over time on reading comprehension as well (see Table 13). Scores go down over the years for both all-day and half-day groups (see Table 5 for the means). No significant effects of time or program were observed for math computation. Time effects are significant, on the other hand for math concepts and applications; but the effects for program are not.

1986-1987 Cohort

For word attack, vocabulary and reading comprehension, the downward trend from 1988 to 1989 is significant for both all-day and half-day groups (see Table 14). It also appears that enrollment in half-day or all-day program makes a significant difference as well in all three subtests: the all-day group performs better than the half-day group. As in the first cohort, math computation deviates from the overall trends observed here. There is no significant time effect, although the effects of program are significant (all-day perform better than half-day). The association between kindergarten math performance and elementary school math computation is significant as well. Significant time and program effects were also found for math concept and applications; 1989 scores being lower than those in 1988, and all-day groups doing better than half-day groups.

Table 13 Repeated Measures Analysis of Covariance with time as a repeated condition, program as a factor level effect, with Readiness scores as a covariate; and CTBS subtests scores as an outcome. Cohort 1986-1987.

Word Attack

Between:	F	df	significance
Readiness	11.12	1,178	**
Program	11.70	1,178	**
Within:			
Time	18.47	1,179	***
TimeXprogram	1.70	1,179	ns

Vocabulary

Between:	F	df	significance
Readiness	10.87	1,177	**
Program	19.87	1,177	***
Within:			
Time	36.88	1,178	***
TimeXProgram	.00	1,178	ns

Reading Comprehension

Between:	F	df	significance
Readiness	9.18	1,178	**
Program	20.67	1,178	***
Within:			
Time	12.60	1,179	***
TimeXProgram	.02	1,179	ns

Math Computation

Between:	F	df	significance
Readiness	9.49	1,79	**
Program	.83	1,79	ns
Within:			
Time	.42	2,160	ns
TimeXprogram	.68	2,160	ns

Math Concepts and Applications

Between:	F	df	significance
Readiness	9.86	1,79	**
Program	.50	1,79	ns
Within:			
Time	22.74	2,160	***
TimeXProgram	.03	2,160	ns

o p .10
* p .05
** p .01
*** p .001

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Table 14 Repeated Measures Analysis of Covariance with time as a repeated condition, program as a factor level effect, with Readiness scores as a covariate; and CTBS subtests scores as an outcome. Cohort 1985-1986

Word Attack

	F	df	significance
Between:			
Readiness	16.10	1,79	***
Program	1.62	1,79	ns
Within:			
Time	1.44	2,160	ns
TimeXprogram	1.45	2,160	ns

Vocabulary

	F	df	significance
Between:			
Readiness	15.02	1,79	***
Program	.84	1,79	ns
Within:			
Time	26.43	2,160	***
TimeXProgram	2.43	2,160	0

Reading Comprehension

	F	df	significance
Between:			
Readiness	19.18	1,79	***
Program	.65	1,79	ns
Within:			
Time	11.66	2,160	***
TimeXProgram	.71	2,160	ns

Math Computation

	F	df	significance
Between:			
Readiness	5.88	1,178	*
Program	19.19	1,178	***
Within:			
Time	.00	1,179	ns
TimeXprogram	1.49	1,179	ns

Math Concepts and Applications

	F	df	significance
Between:			
Readiness	18.33	1,178	***
Program	22.88	1,178	***
Within:			
Time	79.09	1,179	***
TimeXProgram	.01	1,179	ns

? p .10
* p .05
** p .01
*** p .001

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Discussion and Conclusion

The present study was concerned with the effects of all-day versus half-day kindergarten attendance on elementary school performance as measured by CTBS test results. A longitudinal assessment was made of the effects of kindergarten attendance for two cohorts of children, one that started first grade in 1986, and one that started first grade in 1987. For the former cohort, effects for the first two years of elementary school has been examined previously (Azumi, 1986;1977). Both reports reveal a significant advantage of the all-day over the half-day group. Increasing the all-day kindergarten program has been recommended on the basis of these results. The results of the present study support this recommendation, although it was also found that the significance of the differences between all-day and half-day groups disappears in the long run.

The difference between all-day and half-day groups loses statistical significance after the first year of elementary school in the first cohort. In the second cohort, differences remain significant in the second year, but future analysis need to determine whether this difference remains prominent if those children not tested each year are included in the analyses.

In line with the purpose of the study, testing performance over time has been examined for each of the subtests. It appears that for all subtests except math computation, test scores go down over time in both cohorts, indicating that performance of these children declines relative to that of their peers in other states and other school districts. Math computation deviates from this pattern. It remains the same over the years. The absence of an interaction between time and program in all instances indicates that the changes in performance over time are the same for all-day and half-day groups. A significant gap has been observed in math and concept application scores in

1988 for the first cohort indicating that after a drop in 1988, there was a recovery in 1989.

Since the primary purpose of this study has been to examine the effects of kindergarten attendance on elementary school performance, the differences that already existed between all-day and half-day kindergarten attendance groups before they entered the programs were controlled for in the assessment of long term effects. It does not harm the children to be enrolled in all-day kindergarten programs. The advantage of children who are enrolled in an all-day program in the first elementary school year suggests that the all-day children make a better start than their half-day peers. Over time, it appears, however, that the all-day advantage loses its significance. It is important to consider this result in light of the overall decline in performance for both groups. The lack of a long term effect for the all-day groups could indicate that the circumstances under which learning takes place at the primary grades does not enable the all-day group to maintain their advantageous position. Additional empirical research is needed to determine the extent to which children's ability to build on what they have acquired at kindergarten depends on the effectiveness of elementary school instruction.

The results of the present study do not rule out the possibility that in a school where achievement scores tend to go up, all-day kindergarten gives children a lasting advantage over their half-day peers. It is quite conceivable that all-day kindergarten attendance only has a lasting effect if elementary schools provide the opportunity for children to build on their acquired strengths. To establish an empirical basis for such speculations, it is necessary to incorporate the effects of instruction at elementary school, the social climate, and economical infrastructure of the school in the evaluation. To determine the effectiveness of kindergarten programs in the

long run, it seems to be necessary to evaluate the effectiveness of the elementary school instruction to which the children are exposed as well.

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